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Saad Sirohey

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23413 7590 06/14/2007  
CANTOR COLBURN, LLP  
55 GRIFFIN ROAD SOUTH  
BLOOMFIELD, CT 06002

EXAMINER

BROOME, SAID A

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/711,189	SIROHEY ET AL.	
	Examiner	Art Unit	
	Said Broome	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 27 March 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 and 17-50 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 and 17-50 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Response to Amendment***

1. This office action is in response to an amendment filed 3/27/2007.
2. Claims 1, 26, 31, 32, 37 and 50 have been amended by the applicant.
3. Claims 2-15, 17-25, 27-30, 33-36 and 38-49 are original.
4. Claim 16 is cancelled.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 19, 21-26, 43 and 45-50 rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi et al. (hereinafter "Takagi", US Patent 6,269,140) in view of Claus et al. (hereinafter "Claus", US 2005/0135558).

Regarding claim 1, Takagi teaches a method for generating a digital image indicative of an internal anatomy of a person in column 2 lines 53-56 ("*...to provide an X-ray CT apparatus in which sagittal or coronal images, or three-dimensional images effective for diagnosis of a heart or any other organ can be clearly reconstructed...*"). Takagi also teaches scanning the internal anatomy of the person at a plurality of positions along an axis to obtain scanning data in column 3 lines 21-26 ("*...a scan control section for controlling drive of the X-ray source...to thereby perform scan on the periphery of the object with the X-rays in a direction of a sliced face*").

*crossing a body axis of the object...”), wherein the scanning at each position is performed over at least one respiratory cycle of the person, as described in column 3 lines 30-33 (“...and a scan speed control section for receiving an electrocardiogram signal of the object to thereby control a rotational speed of the rotary member on the basis of the electrocardiogram signal.”) and in column 7 lines 2-21 (“...a signal indicating a breath period of the lung is provided in place of the electrocardiograph 50, and the X-ray scan speed in the lung region is controlled synchronously with the breath period of the lung to thereby obtain a clear CT images of the lung without any distortion...which performs periodic and repetitive movement.”), where it is described that the scanning is performed based on a recurring movement, such as a respiratory cycle; and generating a plurality of cross-sectional digital images based on the scanning data, as described in column 3 lines 26-30 (“...an image reconstituting section for generating a slice image signal of the object on the basis of an output signal of the X-ray detector obtained during the scan...”).* Though Takagi does not specifically teach generating first and second cross-sectional digital image groups associated with respective first and second respiratory states, the quantity of the cross-sectional digital image groups does not depart from the scope of invention as disclosed in the applicant’s Specification in paragraph 0061 lines 1-13, therefore no specific quantity of cross-sectional digital image groups may be generated. Therefore Takagi teaches the claimed cross-sectional digital image groups, in which each respective group of images corresponds to a particular respiratory state, in column 6 lines 55-58 (“...to establish a synchronizing relation of phase between the CT scan...and the cardiac pulsation to thereby obtain a plurality of CT images corresponding to one and the same phase of pulsation.”) and in column 3 lines 42-47 (“...receiving an electrocardiogram signal of the object and controlling a

*scan speed of the X-rays synchronously with a period of the electrocardiogram signal; detecting the X-rays transmitted through the object every time the scan is performed to thereby collect image information with respect to a sliced face of the object...*”), where each group comprises two cross-sectional digital images at respective positions along an axis where each of the digital images indicate the internal anatomy at a substantially similar respiratory state, as described in column 6 lines 55-58 (“...to establish a synchronizing relation of phase between the CT scan (rotation of the rotary disc) and the cardiac pulsation to thereby obtain a plurality of CT images corresponding to one and the same phase of pulsation.”), where it is described that a plurality of images are generated for the pulsation, where each respiratory pulsation is known to include two phases: an inspiration and expiration. Takagi also teaches generating 3-D digital images corresponding with respective cross-sectional digital image groups, as described in column 6 lines 60-63 (“...a three-dimensional image or a sagittal (coronal) reconstituted image is formed from a plurality of CT images obtained by scan synchronously with the period of the electrocardiographic complex...”). However, Takagi fails to teach processing the 3-D digital images to obtain a resultant 3-D digital image indicating at least a portion of the internal anatomy of the person. Claus teaches processing the 3-D digital images to obtain a resultant 3-D digital image indicating at least a portion of the internal anatomy of the person in paragraph 0014 lines 11-14 (“Once reconstructed, the images produced by the system of FIG. 1 reveal an internal region of interest of the patient 18 which may be used for diagnosis, evaluation, and so forth.”) and in paragraph 0051 lines 1-10 (“...more than one reconstructed data set or volume may present at one time...For example, reconstructed volumes corresponding to different “states” of the imaged anatomy may be concurrently maintained. An instance where this might be desired is

*in cardiac angiography, where it may be desirable to maintain a reconstructed volume for different cardiac states or phases, as determined from the electrocardiogram signal).*”). Claus also teaches storing all data generated by the computer(36) illustrated in Figure 1, into a memory device in paragraph 0015 lines 1-3, therefore the resultant 3-D images described in paragraph 0051 lines 1-10 would be stored in a memory device. It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi with Claus because this combination would provide three-dimensional digital images of internal anatomy as taught by Takagi, that are generated indicating a particular region within the anatomy that is synchronized to the respiratory cycle of each respective group of images for the subject under analysis, as taught by Claus, thereby decreasing image distortion.

Regarding claims 19 and 43, Takagi teaches that the plurality of cross-sectional digital images comprises a plurality of computerized tomography images in column 4 lines 25-27 (“...*a CT image generating section 23 for forming three-dimensional image information from a series of tomographic image data...*”).

Regarding claims 21 and 45, Takagi teaches the 3-D digital images of a corresponding cross-sectional digital image group comprises 3-D computerized tomography images in column 4 lines 25-27 (“...*a CT image generating section 23 for forming three-dimensional image information from a series of tomographic image data...*”).

Regarding claims 22 and 46, Takagi teaches displaying at least a portion of the resultant 3-D digital image on a display monitor in column 1 lines 54-59 (“*There is also such a CT apparatus in which a three-dimensional image generating section is provided (between the image information adding section 22 and the display circuit section 24) in the data processing*”).

*section so that three-dimensional information is extracted from a series of CT images to thereby display three-dimensional CT images.”), and it is also illustrated in Figure 1 as element 30.*

Regarding claims 23 and 47, Takagi teaches displaying a 2-D portion of the resultant 3-D digital image on a display monitor in column 5 lines 63-67 (*“The data to be sent to the CT image generating section 23 is constituted by a series 300 of several scan sets composed of two-dimensional data (cross-sectional data)...”*), and as is illustrated in Figure 3.

Regarding claims 24 and 48, Takagi fails to teach the limitations. Claus teaches color coding a portion of the resultant 3-D digital image, and displaying the color-coded resultant 3-D digital image on a display monitor in paragraph 0053 lines 1-16 (*“The reconstructed three-dimensional image may be displayed by a volume rendering technique on a display 42 and may be viewed from any direction of interest...The display 42 may be a multi-color display or a gray-scale display that allows the use of color or gray-scale intensity...to differentiate bone and soft tissue, or contrast agent and soft tissue, or the current fluoroscopic image from the volume rendering.”*). The motivation to combine the teachings of Takagi and Claus is equivalent to the motivation of claim 1.

Regarding claims 25 and 49, Takagi fails to teach the limitations. Claus teaches displaying the resultant 3-D digital image on a display monitor using a volume rendering technique in paragraph 0053 lines 1-2 (*“The reconstructed three-dimensional image may be displayed by a volume rendering technique on a display 42...”*). The motivation to combine the teachings of Takagi and Claus is equivalent to the motivation of claim 1.

Regarding claim 26, Takagi teaches a system for generating a digital image indicative of an internal anatomy of a person over a respiratory cycle in column 3 lines 34-50 (*“...an image*

*generating method by using an X-ray computerized tomography apparatus... receiving an electrocardiogram signal of the object and controlling a scan speed of the X-rays synchronously with a period of the electrocardiogram signal...“).* Takagi teaches a respiratory monitoring device generating a first signal indicative of a respiratory state of the person in column 7 lines 2-21 (“...*a device for outputting a signal indicating a breath period of the lung is provided...Further, the present invention can be used for examination of an object having an element which is disposed inside the object and which performs periodic and repetitive movement.*“). Takagi also teaches a scanning device configured to scan an internal anatomy of the person to obtain scanning data in column 3 lines 21-26 (“...*a scan control section for controlling drive of the X-ray source and the rotary member so that the rotary member rotates to thereby perform scan on the periphery of the object with the X-rays in a direction of a sliced face crossing a body axis of the object...*“). Takagi illustrates a computer 20 operably coupled to both the respiratory monitoring device 50 and the scanning device 10 in Figure 1. Takagi also teaches generating a plurality of cross-sectional digital images based on the scanning data, as described in column 3 lines 26-30 (“...*an image reconstituting section for generating a slice image signal of the object on the basis of an output signal of the X-ray detector obtained during the scan...*“). Though Takagi does not specifically teach generating first and second cross-sectional digital image groups associated with respective first and second respiratory states, the quantity of the cross-sectional digital image groups does not depart from the scope of invention as disclosed in the applicant’s Specification in paragraph 0061 lines 1-13, therefore no specific quantity of cross-sectional digital image groups may be generated. Therefore Takagi teaches the claimed cross-sectional digital image groups, in which each respective group of images



corresponds to a particular respiratory state in column 6 lines 55-58 ("*...to establish a synchronizing relation of phase between the CT scan...and the cardiac pulsation to thereby obtain a plurality of CT images corresponding to one and the same phase of pulsation.*"). Takagi teaches generating 3-D digital images, where each digital image is determined from a respective cross-sectional digital image group, as described in column 6 lines 60-63 ("*...a three-dimensional image or a sagittal (coronal) reconstituted image is formed from a plurality of CT images obtained by scan synchronously with the period of the electrocardiographic complex...).*"). However, Takagi fails to teach processing the plurality of 3-D digital images to obtain a resultant 3-D digital image indicating positions of at least a portion of the internal anatomy of the person during at least the respiratory cycle. Claus teaches generating a resultant 3-D digital image indicating positions of at least a portion of the internal anatomy of the person in paragraph 0051 lines 1-10 ("*...more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes corresponding to different "states" of the imaged anatomy may be concurrently maintained. An instance where this might be desired is in cardiac angiography, where it may be desirable to maintain a reconstructed volume for different cardiac states or phases, as determined from the electrocardiogram signal.*"). Claus also teaches storing all data generated by the computer(36) illustrated in Figure 1, into a memory device in paragraph 0015 lines 1-3, therefore the resultant 3-D images described in paragraph 0051 lines 1-10 would be stored in a memory device. It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi with Claus because this combination would provide three-dimensional digital images of internal anatomy as taught by Takagi, that are generated indicating

a particular region within the anatomy that is synchronized to the respiratory cycle of the subject under analysis, as taught by Claus, thereby decreasing image distortion.

Regarding claim 50, Takagi illustrates an article of manufacture 10 in Figure 1. Takagi teaches scanning the internal anatomy of the person at a plurality of positions along an axis to obtain scanning data in column 3 lines 21-26 ("*...a scan control section for controlling drive of the X-ray source...to thereby perform scan on the periphery of the object with the X-rays in a direction of a sliced face crossing a body axis of the object...*"), wherein the scanning at each position is performed over at least one respiratory cycle of the person, as described in column 3 lines 30-33 ("*...and a scan speed control section for receiving an electrocardiogram signal of the object to thereby control a rotational speed of the rotary member on the basis of the electrocardiogram signal.*") and in column 7 lines 2-21 ("*...a signal indicating a breath period of the lung is provided in place of the electrocardiograph 50, and the X-ray scan speed in the lung region is controlled synchronously with the breath period of the lung to thereby obtain a clear CT images of the lung without any distortion...used for examination of an object having an element which is disposed inside the object and which performs periodic and repetitive movement.*"), where it is described that the scanning is performed based on a recurring movement, such as a respiratory cycle, which is performed on a computerized apparatus, as described in column 3 lines 5-6 and is therefore executed using some instructions or program code. Takagi also teaches generating a plurality of cross-sectional digital images based on the scanning data, as described in column 3 lines 26-30 ("*...an image reconstituting section for generating a slice image signal of the object on the basis of an output signal of the X-ray detector obtained during the scan...*"). Though Takagi does not specifically teach generating

first and second cross-sectional digital image groups associated with respective first and second respiratory states, the quantity of the cross-sectional digital image groups does not depart from the scope of invention as disclosed in the applicant's Specification in paragraph 0061 lines 1-13, therefore no specific quantity of cross-sectional digital image groups may be generated.

Therefore Takagi teaches the claimed cross-sectional digital image groups, in which each respective group of images corresponds to a particular respiratory state in column 6 lines 55-58 ("*...to establish a synchronizing relation of phase between the CT scan...and the cardiac pulsation to thereby obtain a plurality of CT images corresponding to one and the same phase of pulsation.*"). Takagi teaches generating a plurality of 3-D digital images, wherein each digital image of the plurality of 3-D digital images is determined from a corresponding one of the plurality of cross-sectional digital image groups, as described in column 6 lines 60-63 ("*...a three-dimensional image or a sagittal (coronal) reconstituted image is formed from a plurality of CT images obtained by scan synchronously with the period of the electrocardiographic complex...*"). However, Takagi fails to teach a computer storage medium having computer code encoded therein for generating a digital image indicative of an internal anatomy and processing the 3-D digital images to obtain a resultant 3-D digital image indicating a portion of the internal anatomy of the person. Claus teaches a computer storage medium having computer code encoded therein, as described in paragraph 0015 lines 1-13, for generating a digital image indicative of an internal anatomy, as described in paragraph 0051 lines 1-10, therefore the scanning and image generation is performed using the computer code stored on the computer storage medium. Claus also teaches processing the plurality of 3-D digital images to obtain a resultant 3-D digital image indicating at least a portion of the internal anatomy of the person in

paragraph 0051 lines 1-10. Claus teaches storing all data generated by the computer(36) illustrated in Figure 1, into a memory device in paragraph 0015 lines 1-3, therefore the resultant 3-D images described in paragraph 0051 lines 1-10 would be stored in a memory device. It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi with Claus because this combination would provide a computer system to generate three-dimensional digital images of internal anatomy as taught by Takagi, that are generated indicating a particular region within the anatomy that is synchronized to the respiratory cycle of the subject under analysis, as taught by Claus, thereby decreasing image distortion.

Claims 2, 4, 27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi in view of Claus in further view of Brandl et al. (hereinafter "Brandl", US Patent 6,450,962).

Regarding claims 2 and 27, Takagi fails to teach the limitations. Claus teaches processing several 3D digital images to obtain a resultant 3D digital image in paragraph 0051 lines 1-10 (*"...more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes corresponding to different "states" of the imaged anatomy may be concurrently maintained."*). However, Takagi and Claus fail to teach perform a minimum intensity projection of the plurality of 3D digital images to obtain the resultant 3D digital image. Brandl teaches performing a minimum intensity projection of 3D images in column 4 lines 63-67-column 5 lines 1-9 (*"The volume rendering algorithms used in accordance with certain embodiments of the present invention to combine adjacent image planes 34 include the following general types: maximum*

*intensity projection, minimum intensity projection...*“). Therefore it would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi, Claus and Brandl because this combination would provide a processed plurality of 3D minimum intensity projection images produced by Brandl, to obtain the resultant 3D digital image, as taught by Claus, thereby enabling a region of interest within the 3D image to be highlighted or intensified to improve analysis of the region.

Regarding claims 4 and 29, Takagi fails to teach the limitations. Claus teaches processing several 3D digital images to obtain a resultant 3D digital image in paragraph 0051 lines 1-10 (“...*more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes corresponding to different "states" of the imaged anatomy may be concurrently maintained.*“). However, Takagi and Claus fail to teach perform a maximum intensity projection of 3D digital images to obtain the resultant 3D digital image. Brandl teaches performing a maximum intensity projection of 3D images in column 4 lines 63-67-column 5 lines 1-9 (“*The volume rendering algorithms used in accordance with certain embodiments of the present invention to combine adjacent image planes 34 include the following general types: maximum intensity projection...*“). Therefore it would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi, Claus and Brandl because this combination would provide a processed plurality of 3D maximum intensity projection images produced by Brandl, to obtain the resultant 3D digital image, as taught by Claus, thereby enabling a region of interest within the 3D image to be highlighted or intensified to improve analysis of the region.

Claims 3, 5, 7-15, 28, 30 and 32-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi in view of Claus, in further view of Brandl and in further view of Yao et al.(hereinafter "Yao", US 2005/0078858).

Regarding claims 3 and 28, Takagi fails to teach the limitations. Claus teaches processing several 3D digital images to obtain a resultant 3D digital image in paragraph 0051 lines 1-10 (*"...more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes corresponding to different "states" of the imaged anatomy may be concurrently maintained."*). Takagi, Claus and Brandl fail to teach that the resultant 3D digital image comprises a first region having a first plurality of voxel intensity values indicative of a tumor and a second region having a second plurality of voxel intensity values indicative of the internal anatomy surrounding the tumor. Yao teaches the resultant 3D digital image comprises a first region having a first plurality of voxel intensity values indicative of a tumor and a second region having a second plurality of voxel intensity values indicative of the internal anatomy surrounding the tumor in paragraph 0016 lines (*"...a variety of feature characteristics can be computed, which can be used to classify the feature as of interest (for example, a polyp) or not of interest (for example, normal tissue)." and in paragraph 0082 lines 1-6 ("...enhancing can alter component intensities to better distinguish between features of interest and features not of interest."*), wherein each of the first plurality of voxel intensity values are greater than each of the second plurality of voxel intensity values, as described in paragraph 0168 lines 1-6 (*"The intensity of a voxel is increased (for example by adjustment(v) shown Equation (8)) if it is in a potential polyp region; otherwise the intensity is decreased. Such an approach can enhance intensities to better distinguish*

*features of interest and features not of interest.*“). It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi, Claus, Brandl and Yao because this combination would provide an accurate display of regions of interest within a digital image through assigning voxel intensity values to regions within the image.

Regarding claims 5 and 30, Takagi fails to teach the limitations. Claus teaches processing several 3D digital images to obtain a resultant 3D digital image in paragraph 0051 lines 1-10 (“...*more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes corresponding to different "states" of the imaged anatomy may be concurrently maintained.*“). Takagi, Claus and Brandl fail to teach that the resultant 3D digital image comprises a first region having a first plurality of voxel intensity values indicative of a tumor and a second region having a second plurality of voxel intensity values indicative of the internal anatomy surrounding the tumor. Yao teaches the resultant 3D digital image comprises a first region having a first plurality of voxel intensity values indicative of a tumor and a second region having a second plurality of voxel intensity values indicative of the internal anatomy surrounding the tumor in paragraph 0016 lines (“...*a variety of feature characteristics can be computed, which can be used to classify the feature as of interest (for example, a polyp) or not of interest (for example, normal tissue).*“) and in paragraph 0082 lines 1-6 (“...*enhancing can alter component intensities to better distinguish between features of interest and features not of interest.*“), wherein each of the first plurality of voxel intensity values are greater than each of the second plurality of voxel intensity values, as described in paragraph 0168 lines 1-6 (“*The intensity of a voxel is increased (for example by adjustment(v) shown Equation (8)) if it is in a potential polyp region; otherwise*

*the intensity is decreased. Such an approach can enhance intensities to better distinguish features of interest and features not of interest.”*). It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi, Claus, Brandl and Yao because this combination would provide an accurate display of regions of interest within a digital image through assigning voxel intensity values to regions within the image.

Regarding claims 7 and 32, Takagi fails to teach the limitations. Claus teaches combining 3D digital images to obtain a resultant 3D digital image in paragraph 0051 lines 1-10 (“...*more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes corresponding to different "states" of the imaged anatomy may be concurrently maintained.*”). However, Takagi and Claus fail to teach performing a maximum intensity projection on a first and second 3D images to obtain a third resultant 3D digital image, generating a boundary within the 3D digital image around a predetermined portion of the internal anatomy of the person and a minimum intensity projection on the third 3D image to obtain a fourth 3D digital image. Brandl teaches generating a maximum intensity projection on a group of 3D images, such as a first and second 3D images, to obtain a resultant third 3D digital image and a minimum intensity projection to obtain a fourth 3D digital image in column 4 lines 63-67-column 5 lines 1-9 (“*The volume rendering algorithms used in accordance with certain embodiments of the present invention to combine adjacent image planes 34 include the following general types: maximum intensity projection, minimum intensity projection...Combination of rendering algorithms can be applied in the volume rendering processor 46.*”), where it is described that 3D images, such as element 16 of Figure 2, may be generated using maximum and minimum intensity projections.



However, Takagi, Claus and Brandl fail to teach generating a boundary within the third 3D digital image around a predetermined portion of the internal anatomy of the person. Yao teaches generating a boundary within the third 3D digital image around a predetermined portion of the internal anatomy of the person in paragraph 0011 lines 1-5 (“...*an anatomical structure can be processed to determine an enclosing three-dimensional boundary of features...polyp boundaries in a virtual colon can be determined by software.*”), in paragraph 0074 lines 1-9 (“...*identification of features of interest in an anatomical structure ...performing computer-aided detection of polyps in a CT scan of the colon, identifying boundary characteristics of polyps...*”) and in paragraph 0076 lines 1-6 (“*A feature of interest includes any feature occurring in an anatomical structure that is of interest...features of interest can include those features that require further review by a human reviewer. For example, features of interest can include cancerous or pre-cancerous growths, lesions, polyps, and the like.*”), where it is described that the portion or region of interest, such as an organ, contains a boundary and is predetermined or indicated by a user. Therefore, It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi, Claus, Brandl and Yao because this combination would provide the ability to combine two 3D digital images, one of a maximum intensity projection, the second of a minimum intensity projection, that would provide a volumetric representation of the both the lower intensity region not of interest and the high intensity region of interest.

Regarding claims 8 and 33, Takagi fails to teach the limitations. Claus teaches processing several 3D digital images to obtain a resultant 3D digital image in paragraph 0051 lines 1-10 (“...*more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes*”

*corresponding to different "states" of the imaged anatomy may be concurrently maintained.*”).

Takagi, Claus and Brandl fail to teach that the resultant 3D digital image comprises a first region having a first plurality of voxel intensity values indicative of a tumor and a second region having a second plurality of voxel intensity values indicative of the internal anatomy surrounding the tumor. Yao teaches the resultant 3D digital image comprises a first region having a first plurality of voxel intensity values indicative of a tumor and a second region having a second plurality of voxel intensity values indicative of the internal anatomy surrounding the tumor in paragraph 0016 lines (“...a variety of feature characteristics can be computed, which can be used to classify the feature as of interest (for example, a polyp) or not of interest (for example, normal tissue).”) and in paragraph 0082 lines 1-6 (“...enhancing can alter component intensities to better distinguish between features of interest and features not of interest.”), wherein each of the first plurality of voxel intensity values are greater than each of the second plurality of voxel intensity values, as described in paragraph 0168 lines 1-6 (“The intensity of a voxel is increased (for example by adjustment(v) shown Equation (8)) if it is in a potential polyp region; otherwise the intensity is decreased. Such an approach can enhance intensities to better distinguish features of interest and features not of interest.”). The motivation to combine the teachings of Takagi, Claus, Brandl and Yao is equivalent to the motivation of claim 5.

Regarding claims 9 and 34, Takagi fails to teach the limitations. Claus teaches color coding a portion of the resultant 3-D digital image, and displaying the color-coded resultant 3-D digital image on a display monitor in paragraph 0053 lines 1-16 (“The display 42 may be a multi-color display or a gray-scale display that allows the use of color or gray-scale intensity,

*respectively, to differentiate bone and soft tissue...*”). The motivation to combine the teachings of Takagi, Claus, Brandl and Yao is equivalent to the motivation of claim 5.

Regarding claims 10 and 35, Takagi fails to teach the limitations. Claus teaches displaying the resultant 3-D digital image on a display monitor using a volume rendering technique in paragraph 0053 lines 1-2 (*“The reconstructed three-dimensional image may be displayed by a volume rendering technique on a display 42...”*). The motivation to combine the teachings of Takagi, Claus, Brandl and Yao is equivalent to the motivation of claim 7.

Regarding claims 11 and 36, Takagi fails to teach the limitations. Claus teaches storing the resultant 3-D digital image in a memory in paragraph 0015 lines 1-3 (*“The computer 36 may comprise or communicate with memory circuitry that can store data processed by the computer 36 or data to be processed by the computer 36.”*). The motivation to combine the teachings of Takagi, Claus, Brandl and Yao is equivalent to the motivation of claim 7.

Regarding claim 12, Takagi fails to teach the limitations. Claus teaches combining one or more 3D digital images to obtain a resultant 3D digital image in paragraph 0051 lines 1-10 (*“...more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes corresponding to different “states” of the imaged anatomy may be concurrently maintained.”*). However, Takagi and Claus fail to teach performing a maximum intensity projection on a group of 3D digital images, such as a first and second 3D images, to obtain a third 3D digital image, generating a boundary within the third 3D digital image around a predetermined portion of the internal anatomy of the person and a minimum intensity projection to obtain a second 3D digital image. Brandl teaches generating a maximum intensity projection to obtain a third 3D digital

image and a minimum intensity projection to obtain a second 3D digital image in column 4 lines 63-67-column 5 lines 1-9 (*"The volume rendering algorithms used in accordance with certain embodiments of the present invention to combine adjacent image planes 34 include the following general types: maximum intensity projection, minimum intensity projection...Combination of rendering algorithms can be applied in the volume rendering processor 46."*), where it is described that 3D images, such as element 16 of Figure 2, may be generated using maximum and minimum intensity projections. However, Takagi, Claus and Brandl fail to teach generating a boundary within the third 3D digital image around a predetermined portion of the internal anatomy of the person. Yao teaches generating a boundary within the third 3D digital image around a predetermined portion of the internal anatomy of the person in paragraph 0011 lines 1-5 (*"...an anatomical structure can be processed to determine an enclosing three-dimensional boundary of features...polyp boundaries in a virtual colon can be determined by software."*), paragraph 0074 lines 1-9 (*"...identification of features of interest in an anatomical structure...performing computer-aided detection of polyps in a CT scan of the colon, identifying boundary characteristics of polyps..."*) and in paragraph 0076 lines 1-6 (*"A feature of interest includes any feature occurring in an anatomical structure that is of interest...features of interest can include those features that require further review by a human reviewer. For example, features of interest can include cancerous or pre-cancerous growths, lesions, polyps, and the like."*), where it is described that the portion or region of interest, such as an organ, contains a boundary and is predetermined or indicated by a user. Therefore, It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi, Claus, Brandl and Yao because this combination would provide the ability to combine two 3D digital images, one of a

maximum intensity projection, the second of a minimum intensity projection, that would provide a volumetric representation of the both lower intensity region not of interest and high intensity region of interest.

Regarding claims 13 and 38, Takagi fails to teach the limitations. Claus teaches processing several 3D digital images to obtain a resultant 3D digital image in paragraph 0051 lines 1-10 (“...*more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes corresponding to different "states" of the imaged anatomy may be concurrently maintained.*”). Takagi, Claus and Brandl fail to teach that the resultant 3D digital image comprises a first region having a first plurality of voxel intensity values indicative of a tumor and a second region having a second plurality of voxel intensity values indicative of the internal anatomy surrounding the tumor. Yao teaches the resultant 3D digital image comprises a first region having a first plurality of voxel intensity values indicative of a tumor and a second region having a second plurality of voxel intensity values indicative of the internal anatomy surrounding the tumor in paragraph 0016 lines (“...*a variety of feature characteristics can be computed, which can be used to classify the feature as of interest (for example, a polyp) or not of interest (for example, normal tissue).*”) and in paragraph 0082 lines 1-6 (“...*enhancing can alter component intensities to better distinguish between features of interest and features not of interest.*”), wherein each of the first plurality of voxel intensity values are greater than each of the second plurality of voxel intensity values, as described in paragraph 0168 lines 1-6 (“*The intensity of a voxel is increased (for example by adjustment(v) shown Equation (8)) if it is in a potential polyp region; otherwise the intensity is decreased. Such an approach can enhance intensities to better distinguish*

*features of interest and features not of interest.*“). The motivation to combine the teachings of Takagi, Claus, Brandl and Yao is equivalent to the motivation of claim 5.

Regarding claims 14 and 39, Takagi fails to teach the limitations. Claus teaches color coding a portion of the resultant 3-D digital image, and displaying the color-coded resultant 3-D digital image on a display monitor in paragraph 0053 lines 1-16 (*“The reconstructed three-dimensional image may be displayed by a volume rendering technique on a display 42... The display 42 may be a multi-color display or a gray-scale display that allows the use of color...to differentiate bone and soft tissue...”*). The motivation to combine the teachings of Takagi, Claus, Brandl and Yao is equivalent to the motivation of claim 5.

Regarding claims 15 and 40, Takagi fails to teach the limitations. Claus teaches displaying the resultant 3-D digital image on a display monitor using a volume rendering technique in paragraph 0053 lines 1-2 (*“The reconstructed three-dimensional image may be displayed by a volume rendering technique on a display 42...”*). The motivation to combine the teachings of Takagi, Claus, Brandl and Yao is equivalent to the motivation of claim 5.

Regarding claim 37, Takagi fails to teach the limitations. Claus teaches combining various 3D digital images, such as a first and second image, to obtain a third resultant 3D digital image in paragraph 0051 lines 1-10 (*“...more than one reconstructed data set or volume may present at one time. Indeed, several reconstructed datasets can co-exist if desired. For example, reconstructed volumes corresponding to different "states" of the imaged anatomy may be concurrently maintained.”*). However, Takagi and Claus fail to teach generating a maximum intensity projection to obtain the third 3D digital image, generating a boundary within the third 3D digital image around a predetermined portion of the internal anatomy of the person and a

minimum intensity projection to obtain a fourth 3D digital image. Brandl teaches generating a maximum intensity projection to obtain the third 3D digital image and a minimum intensity projection to obtain a fourth 3D digital image in column 4 lines 63-67-column 5 lines 1-9 (*"The volume rendering algorithms used in accordance with certain embodiments of the present invention to combine adjacent image planes 34 include the following general types: maximum intensity projection, minimum intensity projection...Combination of rendering algorithms can be applied in the volume rendering processor 46."*), where it is described that 3D images, such as element 16 of Figure 2, may be generated using maximum and minimum intensity projections. However, Takagi, Claus and Brandl fail to teach generating a boundary within the first 3D digital image around a predetermined portion of the internal anatomy of the person. Yao teaches generating a boundary within the third 3D digital image around a predetermined portion of the internal anatomy of the person in paragraph 0011 lines 1-5 (*"...an anatomical structure can be processed to determine an enclosing three-dimensional boundary of features...polyp boundaries in a virtual colon can be determined by software."*), paragraph 0074 lines 1-9 (*"...identification of features of interest in an anatomical structure...performing computer-aided detection of polyps in a CT scan of the colon, identifying boundary characteristics of polyps..."*) and in paragraph 0076 lines 1-6, where it is described that the portion or region of interest, such as an organ, contains a boundary and is predetermined or indicated by a user. Therefore, It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi, Claus, Brandl and Yao because this combination would provide the ability to combine two 3D digital images, one of a maximum intensity projection, the second of a minimum intensity projection,

that would provide a volumetric representation of the both lower intensity regions not of interest and high intensity regions of interest.

Regarding claim 41, Takagi fails to teach the limitations. Claus teaches storing the resultant 3-D digital image in a memory in paragraph 0015 lines 1-3 (*"The computer 36 may comprise or communicate with memory circuitry that can store data processed by the computer 36 or data to be processed by the computer 36."*) and in paragraph 0005 lines 1-7 (*"...a method is provided for generating a three-dimensional image...At least one three-dimensional image may be reconstructed..."*). The motivation to combine the teachings of Takagi, Claus, Brandl and Yao is equivalent to the motivation of claim 5.

Claims 6 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi in view of Claus in further view of Caoili et al. (hereinafter "Caoili", *"Urinary Tract Abnormalities: Initial Experience with Multi-Detector Row CT Urography"*).

Regarding claims 6 and 31, Takagi fails to teach the limitations. Claus teaches processing several 3D digital images to obtain a resultant 3D digital image in paragraph 0051 lines 1-10. However, Takagi and Claus fail to teach perform an average intensity projection of the plurality of 3D digital images to obtain the resultant 3D digital image. Caoili teaches performing an average intensity projection of 3D images on page 354 second column second paragraph lines 9-22 (*"The 3D reconstructions in coronal and bilateral 25° coronal oblique projections were created with...average intensity projection (AIP), and volume-rendering algorithms...Curves for the volume-rendered images were chosen to preferentially show enhanced soft tissue and contrast-opacified structures."*). Therefore it would have been obvious to one of ordinary skill in



the art to combine the teachings of Takagi, Claus and Caoili because this combination would provide a processed plurality of 3D average intensity projection images produced by Caoili, to obtain the resultant 3D digital image, as taught by Claus.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi in view of Claus, in further view of Yanof et al. (hereinafter "Yanof", US 2003/0188757).

Regarding claim 17, Takagi and Claus fail to teach the limitations. Yanof teaches scanning the internal anatomy of the person comprises monitoring a position on a chest of the person during respiration by the person to determine the time period of the respiratory cycle of the person in paragraph 0035 lines 1-9 ("*The respiratory monitor system 12 includes a respiratory sensor 20 preferably formed as a belt 22 adapted for attachment around the abdomen or chest of a patient...the respiratory sensor 20 includes an air bellows sensor and pressure transducer (not shown) for generating a signal corresponding to the displacement of a patient's abdomen during respiration.*"), and as shown in Figure 1 as element 22. It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi, Claus and Yanof because this combination would provide accurate monitoring of the respiratory cycle of a person.

Claims 18, 20, 42 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi in view of Claus, in further view of Yao.

Regarding claims 18 and 42, Takagi and Claus fail to teach the limitations. Yao teaches at least a portion of the internal anatomy of the person comprises a tumor, or cancerous growth,

in paragraph 0076 lines 1-6 (“...*features of interest can include those features that require further review by a human reviewer...features of interest can include cancerous or pre-cancerous growths, lesions, polyps, and the like.*”). It would have been obvious to one of ordinary skill in the art to combine the teachings of Takagi, Claus and Yao because this combination would provide a user with the capability to visualize three-dimensional images of particular regions of analysis, specifically regions of cancerous growths, such as tumors.

Regarding claims 20 and 44, Takagi, Claus and Brandl fail to teach the limitations. Yao teaches the plurality of cross-sectional digital images comprises a plurality of magnetic resonance images in paragraph 0087 lines 1-6 (“*Imaging includes any techniques for obtaining an image of the inside of a body...Imaging includes...magnetic fields (such as MRI).*”). The motivation to combine the teachings of Takagi, Claus, Yao is equivalent to the motivation of claim 18.

### ***Response to Arguments***

Applicant's arguments filed on 3/27/2007 with respect to claims 1-15 and 17-50 have been considered but are moot in view of the new ground(s) of rejection.

The 35 U.S.C. 101 rejection of claims 1-8, 12, 13, 16-21 and 25 has been withdrawn with respect to the current interpretation of 35 U.S.C. 101, in which as long as a practical application is claimed or disclosed, the claims are statutory.

The applicant argues that the references Takagi in view of Claus do not teach a first cross-sectional digital image group including first and second digital images obtained at first and second position respectively along the axis when the person has the first repository state, and a

second cross-sectional digital image group including third and fourth digital images obtained at third and fourth positions respectively along the axis when the person has the second repository state. However the arguments are not persuasive because the quantity of cross-sectional digital image groups may not be limited specifically to just two groups as disclosed in the applicant's Specification in paragraph 0061 lines 9-13, therefore one or more image groups may be generated so long as each group of images corresponds to a particular respiratory state. Therefore Takagi, which teaches the generation of cross-sectional digital image groups that correspond to a particular respiratory state in column 6 lines 55-58 ("*...to establish a synchronizing relation of phase between the CT scan (rotation of the rotary disc) and the cardiac pulsation to thereby obtain a plurality of CT images corresponding to one and the same phase of pulsation.*") at respective positions for each respiratory state as described in column 5 lines 35-38 ("*...sliced faces in one and the same region are scanned synchronously with the phase of the electrocardiogram... Thus, if the synchronizing phase of the electrocardiogram is shifted successively while one and the same region are scanned, the state of the cardiac pulsation can be reconstituted as an animation.*"), it would therefore have enabled one of ordinary skill in the art at the time of invention to generate one or more groups of cross-sectional images, thereby enabling the generation of a first, second, or any number of subsequent cross-sectional digital image groups wherein each group would correspond to a particular respiratory state of a person.

The applicant also argues that the Examiner made a contradictory assertion that Takagi teaches the first and second cross-sectional digital image group, after previously stating that Takagi does not specifically teach the first and second groups. However, it was stated in the previous office action on page 4 lines 16-17 that "Takagi does not specifically teach generating

first and second cross-sectional digital image groups”, but rather teaches “cross-sectional digital image groups”(as described on page 4 lines 21-22), which therefore would have enabled one of ordinary skill in the art at the time of invention to generate not only a first and second, but any number of subsequent groups of cross-sectional digital images based on the teaching of Takagi in column 3 lines 42-47 and in column 6 lines 55-58, because the quantity of the image groups does not deter from the scope of invention.

The applicant argues that the reference Takagi does not teach a first cross-sectional digital image group including first and second digital images obtained at first and second positions, respectively, along the axis, when the person has the first repository state. However the arguments are not persuasive because Takagi teaches generation of cross-sectional digital image groups obtained at first and second positions in column 3 lines 30-33 (“...*and a scan speed control section for receiving an electrocardiogram signal of the object to thereby control a rotational speed of the rotary member on the basis of the electrocardiogram signal.*”) and in column 5 lines 35-38 (“...*sliced faces...are scanned synchronously with the phase of the electrocardiogram...the synchronizing phase of the electrocardiogram is shifted successively while one and the same region are scanned...*”), where it is described that the group of digital images are collected by shifted to several positions with respect to a rotational rate along an axis in response to a respiratory state, therefore the captured positions of the digital image groups are directly dependent on the rotational shifting about the axis in relation to the respiratory signal.

The applicant also argues that the reference Takagi does not teach a first cross-sectional digital image group including first and second digital images obtained at first and second positions, respectively, along the axis, when the person has the first repository state, and a

second cross-sectional digital image group including third and fourth digital images obtained at third and fourth positions, respectively, along the axis, when the person has the second repository state. However the arguments are not persuasive because Takagi teaches generating cross-sectional digital image groups including digital images obtained at a plurality of positions along the axis when the person has a repository state in column 4 lines 65-67 – column 5 lines 1-6 (*“The position of the object 18 or the scanner gantry section 10 is slightly moved in the direction of the body axis, and scan for another sliced face is started at the phase of the next R wave...tomographic images in a plurality of different sliced faces can be obtained...the sliced faces are data at the identical phase of cardiac pulsations.”*), therefore one of ordinary skill in the art at the time of invention would have been capable of generating one or more groups of cross-sectional digital images at respective positions that each correspond to a respiratory state along the axis, because the quantity of image groups does not abstain from the scope of invention.

The applicant argues that the references Takagi and Claus do not teach generating a resultant 3-D digital image by utilizing first and second 3-D digital images. However Takagi teaches generating 3-D digital images corresponding with respective cross-sectional digital image groups in column 6 lines 60-63 (*“...a three-dimensional image or a sagittal (coronal) reconstituted image is formed from a plurality of CT images obtained by scan synchronously with the period of the electrocardiographic complex...”*), and Claus teaches generating a resultant 3-D digital image utilizing first and second 3-D digital images in paragraph 0051 lines 1-10 (*“...more than one reconstructed data set or volume may present at one time...reconstructed volumes corresponding to different “states” of the imaged anatomy may be*

*concurrently maintained...in cardiac angiography...it may be desirable to maintain a reconstructed volume for different cardiac states or phases, as determined from the electrocardiogram signal).“*), where it is described that several three-dimensional sets that correspond to different phase or repository states may be generated together at one time, therefore the 3-D digital image groups taught by Takagi would have been capable of generating a combined resultant three-dimensional image through the teaching of Claus thereby providing the user with a collection of slices at several respiratory phase that may then be visualized at one time as a combined realistic volumetric data set, thereby reducing the amount of data sets required to be analyzed by a user.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Said Broome whose telephone number is (571)272-2931. The examiner can normally be reached on M-F 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on (571)272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Said Broome/  
Art Unit 2628  
6/4/07



Ulka Chauhan  
Supervisory Patent Examiner